Memoirs of Explorations in the Basin of the Mississippi. Volume V. Kakabikansing. By J. V. BROWER, . . . with a contributed section by N. H. WINCHELL, . . . St. Paul, Minn.: 1902. 126 pp., 26 plates, 13 figures, 5 maps, 4°.

Mr Brower, President of the Quivira Historical Society, Saint Paul, Minn., has been for a number of years an enthusiastic student of the Northwest, and has published several memoirs on the history, geography, and archeology of that region. His work is characterized by care and accuracy in the collection of data and by caution in reaching and announcing conclusions. In his researches at Little Falls, Minn., he has been so fortunate as to have associated with him Prof. N. H. Winchell, President of the Geological Society of America, whose well-known attainments as a geologist are supplemented by a mastery of the fundamental problems of American archeology. Mr Warren Upham, Secretary of the Minnesota Historical Society, and Mr J. B. Chaney also took part in the exploration, which was conducted with all possible care under eminently favorable conditions.

The report is presented in four sections. Section I deals with the earlier explorations at Little Falls and the publications relating thereto. Professor Winchell was the first to study the archeological phenomena of the site (1877). He observed the occurrence of objects of flaked quartz at a depth of three or four feet in the sands and gravels, and expressed the opinion that this indicated the presence of man in the region in pre-glacial times. He also reached the conclusion that the mound-builders, since their remains are associated with superficial deposits only, should be identified with the Indian tribes of the present period.

In 1878 Miss Frances E. Babbitt made collections of the shaped quartzes from the surface on the river bank, assigning them to a definite horizon at the base of the glacial deposits, and classifying them, under advice from Professor Putnam and others, as paleolithic.

The third explorer was W. H. Holmes, who, in 1892, made excavations at the point from which Miss Babbitt obtained her collections, and found that the objects were not confined to a particular stratum near the base of the series, but occurred in superficial deposits subject to disturbance from various causes; that they were thus probably the work of tribes known historically.

Later (1899) Mr Oscar H. Hershey explored the site and was led to believe that all the quartz objects were post-glacial and of comparatively recent origin.

Section II describes explorations conducted by the author.[1] The

[1] Invitations to be present during the examinations were extended to a number of

geological history of the Falls locality is reviewed, and the origin and relations of the various deposits concerned in the researches are, as understood at the present time, fully expounded. The archeological work was taken up with a clear understanding of the problems to be considered. Excavations were made at various crucial points, and the published photographic views disclose the character of the formations, as well as the position of the included artifacts. The objects secured have been carefully preserved by Mr Brower in museum jars in his private collection, and illustrations of these (plates 8 to 14) accompany the volume.

Section III is devoted to a study of the full range of local relics and remains. Four classes of these are recognized: (1) those relating to the white population, 1659–1901; (2) those of the Ojibwa occupancy, beginning about 1750; (3) those of the Siouan (mound-builders) occupancy, given a time limit not exceeding two thousand years; and (4) those of glacial time, covering an indefinite period beginning some ten thousand years ago. Distinctions are drawn between the artifacts of the glacial race and those of the mound-building tribes, and a period of indeterminate length is assumed by the author to separate the disappearance of the former people and the appearance of the latter. The conclusions that man was present in the basin of the Mississippi before the ice-sheet of the last glacial epoch had disappeared from the northern part of Minnesota and that his culture was paleolithic, are strenuously enforced.

Section IV is a discussion of "The geology of the Mississippi valley at Little Falls," by N. H. Winchell. We have here a full analysis of the geological conditions beginning in glacial times and extending down to the present, and a discussion of these phenomena in their relations to the history of man. Professor Winchell distinguishes four steps in the glacial geology of Little Falls, and his review of the previous studies of the site and his statement regarding "the result reached by the present investigation" are so clear that they should be quoted in full (page 101):

"(1) *The glacial epoch proper*, when ice covered the country to a great thickness and extended indefinitely southward.

"(2) *The gravel accumulating epoch*, when the ice-margin was at or but little above Little Falls. It was so near, and the slope of the ice was so precipitous, that the materials supplied by the glacier were immediately washed by the glacial waters, the clays being carried away, while the gravels were spread in stratified assortment over the till sheet

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persons, and the present writer regretted most sincerely his inability to take part in the work.

which still underlies them. The ice-margin continued to retreat northward, forming a sheet of stratified gravel and sand all the way, but

"(3) At Little Falls during this retreat was the *extended river and ice-jamming period*, marked by the disturbance of the upper part of the gravels and by the introduction of the quartzes.

"(4) The shrinkage of the river to its present size and the *cutting of the narrow present channel*. This epoch may have lasted 10,000 years and continues to the present.

"The opinion of Miss Babbitt that these chippings are of glacial age was based on faulty observation. She explored the east bank of the river at 'The Notch,' where she reported the finding of a continuous layer of quartz chippings underlying the major part of the glacial gravels. She also failed to notice that they occur on the surface generally at that place. Her errors have been pointed out fully by Prof. W. H. Holmes,[1] and her conclusions are shown to be invalid.

"Mr Warren Upham accepted in the main the work of Miss Babbitt and reached the conclusion that the man who chipped the quartz lived at Little Falls during the accumulation of the undisturbed gravels, i. e., that the ice was still present in the immediate vicinity.[2] He made no distinction between the disturbed and the undisturbed portions of these gravels. It is now known that the chips do not occur in the undisturbed gravels.

"Profs. Putnam and Haynes also followed the descriptions and conclusions of Miss Babbitt, supported as they were by Mr Upham.

"Prof. W. H. Holmes made a thorough examination of the locality, and published his conclusions in April, 1893.[3] The writer accompanied Prof. Holmes and concurred in his findings that the quartzes described at 'The Notch' by Miss Babbitt were not in, nor below any normal glacial deposits, and that they are, on the other hand, found only in surface materials of the general flat on which the city is built. Mr Holmes reached the conclusion that all the chippings are quite late, certainly postglacial, and probably due to the existing Indian tribes. This result may have been reached in part by reason of the existence of quartz chippings immediately associated with other implements in the very surface materials, even in the soil, in groups and pockets, such as can be attributed readily to the present Indian. These are found on the west side of the river, and on the lower terraces all the way to Pike Rapids, and probably extend widely.

"Mr O. H. Hershey first differentiated these modern chippings from those found in the disturbed glacial gravels,[4] and assigned a probable later date to the former. This distinction seems to be important and tends to weaken any conclusion that ascribes all the chippings to one and the same date and origin; and it tends to separate under different causes a lot of facts that have been looked on as attributable to a single cause.

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[1] *American Geologist*, vol. XI, pp. 218–240, April, 1893.

[2] Ibid., vol. XIII, p. 363, 1894.

[3] Ibid., vol. XI, pp. 218–240, 1893.

[4] Ibid., vol. XXIV, pp. 283–294, 1899.

"The result reached by the present investigation differs from all the foregoing. It recognizes a period of 1,000 or 2,000 years during which the Mississippi flowed as a majestic river past the site of Little Falls, submerging all the plain from two to two and a half miles wide between the outer drift bluffs. This was wholly subsequent to the accumulation of the glacial gravels. It was during this period that these chips were formed, and were introduced, probably by floating and jamming ice and floodwood, into the uppermost three or four feet of those gravels. The quartz and slates must have formed a small projecting knob above the surface of the water, and probably there was annually considerable dry land in the immediate vicinity on which the quartz chippers did their primeval work. Since that time this projecting knob of quartz and slate has been greatly reduced, but it has always formed an interesting obstruction in the current of the river. The overthrow of trees by tornadoes and the action of burrowing animals may have contributed later to the disturbance of these gravels, but they seem to be insufficient to produce the grand effect. The quartzes must have preceded the disturbance, and the only adequate cause of the disturbance is one that acted, as it appears, while the river was swollen by glacial waters coming from far north. That makes the chippers post-glacial, but much earlier than the present Indian."

The differentiation of the superficial "disturbed" deposits (No. 3) from the underlying stratified gravels, is a very important result, and Professor Winchell may be right in his interpretation of their age and of the manner in which the flaked quartzes were introduced. Even though this interpretation should be accepted, however, it can hardly be claimed with safety that a quartz-chipping site on a rock and a sand-bar in the midst of the wide flood-swept river would contain so full a representation of the culture of the people (if such existed) as to enable us to determine its status. There is, however, nothing inherently improbable in the proposition that the Mississippi valley was inhabited during the period which witnessed dawning civilization of the Nile seven or eight thousand years ago, or in the theory that the culture of this people was so primitive as to be properly called paleolithic.

Section V gives "Conclusions based on ascertained facts and acquired knowledge," by J. V. Brower, who, under eighteen heads, presents a résumé of the geologic and archeologic evidence and the conclusions reached. An Appendix to the volume includes a letter from Professor Winchell, and a brief paper on "Man in the Ice Age," by Mr Warren Upham.

This publication marks a decided step in advance in the study of early man in America. The researches were deliberately planned and the methods employed were thoroughly scientific, and the fortunate combination of talent enlisted must command for the work respect of all students of the history of man. W. H. HOLMES.